WHAT IS CLAIMED IS:

1. A primary lithium electrochemical cell comprising:

a cathode including lambda-manganese dioxide;

an anode including lithium;

a separator between the anode and the cathode; and

an electrolyte contacting the cathode, the anode and the separator,

wherein the cell has an average closed circuit voltage of about between about 3.8 and 4.1V and a specific discharge capacity to a 3V cutoff of greater than 130 mAh/g at a nominal discharge rate of 1 mA/cm^2.

2. The electrochemical cell of claim 1, wherein the cell has a 3V cutoff of greater than 135 mAh/g.

3. The electrochemical cell of claim 1, wherein the cell has a 3V cutoff of 140 mAh/g or greater.

4. The electrochemical cell of claim 1, wherein the lambda-manganese dioxide is maintained at a temperature of less than 150°C during processing or cathode fabrication.

5. The electrochemical cell of claim 1, wherein the cathode containing the lambda-manganese dioxide is maintained at a temperature of 120°C or less during processing or fabrication.

6. The electrochemical cell of claim 1, wherein the lambda-manganese dioxide has a BET surface area of greater than 4 m^2/g.

7. The electrochemical cell of claim 1, wherein the lambda-manganese dioxide has a BET surface area of greater than 8 m^2/g.

8. The electrochemical cell of claim 1, wherein the lambda-manganese dioxide has a total pore volume of from 0.05 to 0.15 cubic centimeters per gram.

9. A primary lithium electrochemical cell comprising:

a cathode including lambda-manganese dioxide having a total pore volume of greater than 0.11 cubic centimeters per gram, and the lambda-manganese dioxide has a BET surface area of greater than 8 m^2/g, wherein the lambda-manganese dioxide is maintained during processing at a temperature of 120°C or less;

an anode including lithium or a lithium alloy;

a separator between the anode and the cathode; and

an electrolyte contacting the cathode, the anode and the separator,

wherein the cell has an average closed circuit voltage of about 4V, a specific discharge capacity to a 3V cutoff of greater than 130 mAh/g at a nominal discharge rate of 1 mA/cm^2.

10. The electrochemical cell of claim 9, wherein the cell has a 3V cutoff of 135 mAh/g or greater at a nominal discharge rate of 0.4 mA/cm^2.

11. A method of preparing lambda-manganese dioxide comprising:

contacting water with a compound of the formula $Li_{1+x}Mn_{2-x}O_4$, wherein x is from –0.02 to +0.02;

adding an acid to the water and compound until the water has a pH of 1 or less;

separating a solid from the water and acid; and

drying the solid at a temperature of 120°C or below to obtain the lambda-manganese dioxide.

12. The method of claim 11, wherein the compound has a BET surface area of between 1 and 10 m^2/g.

13. The method of claim 11, wherein the compound has a spinel-type crystal structure.

14. The method of claim 11, wherein the solid is dried at a temperature between 30°C to 90°C.

15. The method of claim 11, wherein the solid is dried at a temperature between 50°C and 70°C.

16. The method of claim 11, wherein x is from –0.005 to +0.005.

17. The method of claim 11, wherein contacting water and the compound includes forming a slurry.

18. The method of claim 17, wherein the slurry is maintained at a temperature below 50°C.

19. The method of claim 11, wherein the acid sulfuric acid, nitric acid, perchloric acid, hydrochloric acid, toluenesulfonic acid or trifluoromethylsulfonic acid.

20. The method of claim 17, wherein the temperature of the slurry is held substantially constant during the addition of acid.

21. The method of claim 11, wherein the pH is 0.7 or less.

22. The method of claim 11, wherein the acid has a concentration of between 1 and 8 molar.

23. The method of claim 11, further comprising washing the solid separated from the liquid phase with water until the washings have a pH of between 6 and 7.

24. A method of manufacturing an electrochemical cell comprising:

providing an positive electrode including a lambda-manganese oxide; and

forming a cell including the electrode and a lithium negative electrode,

wherein the cell has a closed circuit voltage of about 4V and a specific discharge capacity at a nominal discharge rate of 1 mA/cm^2 to a 3V cutoff of greater than 120 mAh/g.

25. The method of claim 24, wherein providing the electrode includes preparing lambda-manganese dioxide by a method comprising:

contacting water with a compound of the formula $Li_{1+x}Mn_{2-x}O_4$, wherein x is from –0.02 to +0.02;

adding an acid to the water and compound until the water has a pH of 1 or less;

separating a solid from the water and acid; and

drying the solid at a temperature of 120°C or below to obtain the lambda-manganese dioxide.